

The Spatial Aural **EXCITER**

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ABSTRACT

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<p><i>Abstract</i></p> <p>Sound can change the world and so can listening. The written part of my thesis is examining the urban acoustic environment with the aid of two frameworks illuminating the perspectives of sound as an event and sound as an effect. It gives an overview of the universe of sound in the context of the urban sonic environment and elucidates the discourse on noise and its beauty.</p> <p>My practical work is the creation of a network of electronic sounds which opens the possibility to explore and discover densities of sound events, and their temporal and spatial diffusion. The aim is to develop a prototype which can be used as a tool for further artistic explorations.</p> <p>It is a spatial intervention and a sonic network at the same time. The piece is inspired by the immense variety of sound impressions from everyday experiences.</p> <p>The way we listen is part of how we see the world.</p>		
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1. Introduction

1.1. Aim and Motivation

After some years of experience on various projects involving sound in different medias in the fields of film, free art and music, but also everyday circumstances, I learned that listening can be a trained skill for a specific purpose, for instance in music, but it is also part of everyday life situations where everybody creates his own expertise. Listening is an important process in creating an image, a cognitive map of our environment around us. How we hear the world and how we listen to it, has a lot of influence on how we perceive and think about the world around us.

I got fascinated by the different aspects influencing these factors which are important in basic daily routines. Listening signifies also a fundamental awareness in what is going on around us but is also at the same time the process to be aware of oneself. I assume throughout this written work that one is of curious nature and open to explore the environment through listening.

The process of making sense of a surrounding environment involves the perceptual paradigm of figure and ground, a process of grouping and making an order. In the meaning of forming dualistic perceptual layers I noticed that the staging of a figure, the ground is of significant importance. I recognized that Listening demands practice, is an instrument, is an active process like speaking or making sound or washing the dishes and that listening is a fundamental condition for developing an attitude of openness towards the environment around oneself.

The goal of this written part of my thesis is to give an overview of the theory examining the urban universe of sound and about the origin of my practical work, the process involved and in what context I see the work.

1.2. Workplan

I have been studying two distinct approaches to the sonic urban environment. I will introduce the concept based on the sound event, *The World Soundscape Project* (WSP), an international research project initiated by R. Murray Schafer at the Simon Fraser University in Canada as a reaction to the increasing environmental noise pollution. The term *soundscape*¹ is openly defined as any part of a sonic environment, which may be a specific location and its sonic surroundings or even a musical composition in any mediated form.

The focus of the project lies in *Acoustic Ecology*, the study of the relationship of organisms and the acoustic environment they are living in. The study is based on publications by researchers from the fields of sociology and musical composition, and deals with the relationship of organisms and the acoustic environment they are living in mediated through sound.

The WSP has established a valuable vocabulary, realized various projects in different media which were pioneering for future sound related studies.²

Another important work concerned with urban spaces is *sonic experience*, *A Guide to Everyday Sounds*, which is based on the sound effect and which I will refer to as the *Guide to Sonic Effects* throughout the thesis.³

The development of the *Guide to Sonic Effects* was based on interviews of inhabitants collected by researchers of CRESSON at the National School of Architecture of Grenoble in France for the fields of social sciences, urban studies and applied acoustics.

The intention was to publish a guide which would serve as a reference for the work in the field of architecture and urban planning which would not be limited by an aesthetic debate.

The universe of sound with the possibility to connect it to so many interdisciplinary areas is the strength of sound as a medium but is also making it very difficult to approach sound just

1 (R. Schafer, 1994, p. 7)

2 For example: *the Vancouver soundscape* (1973), *Five village Soundscapes* (2010)

3 *A Guide to Everyday Sounds* was finally published in French in 1995, edited by Jean-Francois Augoyard and Henry Torgue with the title *à l'écoute de l'environnement, Répertoire des effets sonores* and then translated and published as an english version as *sonic experience, A Guide to Everyday Sounds* in 2005.

from one point of view without simplifying the matter. Sound is always subject to individual perception and an objective cause.

There are numerous ways to classify sound and there are many forms and modes describing the sort of attention I am referring to as listening. I realized that I can not discuss all possible viewpoints in the scope of this thesis, therefore I would like to focus on how one is listening to the acoustic environment under the guidance of these frameworks which are examining the sonic environment and what is its point of reference and intention.

The urban environment is where I personally live in and where I see the context of the practical work of my thesis. The Spatial Aural Exciter is a network of sounds, a formation of electronic sound events in a net structure to be suspended as an intervention in public space which aims at evoking a spatial aural experience.

2. The Act of Listening

2.1. Hearing – Listening

One can ignore a sound by not listening to it by focusing on an other sound, but one would still hear both of them. One could distinguish listening and hearing as two opposite modes of perception, active and passive.

The act of listening signifies more than the concentrated attention one is paying to something particular in the range of what can be heard. Listening is a selective and active process consciously controlled. Hearing defines the physiological condition that one perceives sound with ones ear.

We are listening all the time but on different *levels of attention* for the particular in the environment in exclusion of others.⁴

2.2. The Fore- and Background Paradigm

One is able to listen to everything but one cannot focus and process a multitude of sounds at the same time. We favor one over the other. This process is explained in detail by its visual equivalent of figure and ground outlined as part of the Gestalt psychology by E. Rubin.⁵

The fundamental assumption in the organization of perception in foreground and background is used by the *Guide to Sonic Effects*⁶ and also by the *WSP*⁷.

4 (Truax, 2001, p. 16)

5 (Yantis, 2001, pp. 225–229)

6 (Augoyard 2005, p.74)

7 (R. Schafer 1994, p.275)

The *WSP* divides the components of an acoustic environment into *sound signals* and *keynote sounds*.⁸ Schafer created the term *keynote sounds* which is derived from the musical domain and is describing a sound which is heard often or even continuously and is in this way a fundamental element, not separable from the particular acoustic environment. *Keynote sounds* are also the sounds which are characterizing one of the three modes of listening elucidated by composer and acoustic communication researcher Barry Truax.⁹

Background listening is a mode of listening when sound events are not specially noticed. One is aware of their presence still after some fairly large amount of time but one has not been paying any attention to them because one has adapted them to one's own environmental cognitive pattern.

The complexity of selective listening in relation to the capability of listening to everything is described by phenomenological philosopher Maurice Merleau-Ponty as a circumstance where the point of interest which we are intending to perceive is constantly part of another area of relationships.¹⁰

The *Guide to Sonic Effects* defines the process of selective listening and how one is organizing aural perception using two major and complementary effects called the *synecdoche* and *asyndeton* effects.

The *synecdoche* effect signifies the ability to focus on a specific element out of a complex sound ambiance and the *asyndeton* effect stands for the capability to exclude a sound from an audible environment. The same aspects are gathered in the listening mode named *listening-in-search* by Truax. Especially this mode of listening is used in the process of echolocation, producing a sound to determine obstacles.

The Radioplay *Tanz Für Zwei Blaue Rechtecke* (1996) with sound made by Rolf Julius is nicely dealing with the mentioned issue.

8 (Truax 1984, p.22)

9 *Listening-in-search, Listening-in-readiness, Background listening*

10 (Merleau-Ponty 2002, p.4)

3. Continuum & Territory

3.1. Listening to Noise

I am elucidating two different paradigms examining the urban soundscape, one emphasizing or building on the existence of noise, the other rather on its qualities and effects. I have come across variations of the term noise as continuous sound, constant sound, constant intensity, the flat line in sound or background noise, which are all descriptions of noises of the same kind. The descriptive terms are supposing that a component or parameter is persistent, does not change, like time or intensity.

In a way noise is every unwanted sound, the sound that is distracting oneself of keeping a focus on something. Noises are mostly loud sounds, maybe not making any sense to us, or not carrying the information we are seeking for. Noise pollution is a term which is strongly related to the *WSP*. Even the term is culturally adaptable and sound level can be measured objectively, loudness and the possible content of noise are of subjective nature.

3.2. Hi-Fi / Lo-Fi

Schafer utilizes the terms *hi-fi* and *lo-fi* to define the quality of an acoustic environment.¹¹ A *hi-fi* soundscape defines itself by its high fidelity which means that a sound can be distinguished clearly from other sound sources on a certain distance. For example defined by an environment where one still is able to hear one's own footsteps.

A *low-fi* soundscape would characterize itself through high volume in ambient noise level. Discrete sounds in a *lo-fi* environment can not be heard clearly or are even impossible to be heard already after a short distance from the sound source of attention.

¹¹ *hi-fi* and *lo-fi* are abbreviations for high and low fidelity originating from the vocabulary of audio reproduction industries, to formulate the amount of noise, distortion and frequency accuracy in a given signal.

Schafer integrates the acoustic range of a sound event from two opposite points of views:

he defines the *acoustic space* as the volume of space a sounding object can be perceived in, and the *acoustic community* which describes a community based on sound. Truax introduces the concept of *feedback systems* in terms of *hi-fi* and *lo-fi* environments.¹² He explains the function of actively making sound as a process of giving feedback on specific circumstances which helps in orientating oneself, especially of ourselves in relation to others.

All our senses are involved and take part in creating an image of our surrounding environment.¹³ Our ability to hear provides important information to complete the picture of where we are now and is also important in whatever decision making process we are in.

For example by hearing an approaching car we can estimate its distance and also have an idea of its speed and maybe even how long it will take approximately until the car will be very close. A few people even could say something about the specifications of the car without having seen it, an ability that, composer and researcher in audio-visual relationships, Michel Chion classifies as *causal listening*.¹⁴

It is a mode of listening we use constantly in everyday life which deals with the information we gather from hearing and how we causally interpret what we can not see or what we imagine to see.

Animals with a more extended hearing range like whales, dolphins and bats, use the technique of echolocation by emitting sound in a frequency spectrum not perceivable for us humans for maneuvering themselves around or for locating potential enemies or food possibilities. Not just animals but also we humans use the same technique to get information about the structure of our surrounding by listening how sound gets formed through the spatial conditions.

The way we find out from which direction a certain sound originates is validated through which ear reaches the sound wave first. The difference in time of stimulation in each ear, the intensity and the timbre, the spectral character and the quality. Using all these characteristics of the sound in combination with all senses and the cognitive work of memorizing, comparing

12 (Truax 1984, p.20)

13 (Blessner 2007)

14 (Chion 1994, p.25)

and adapting whole patterns of information we create a cognitive spatial image of our surrounding and its context.

Truax refines the framework of the *WSP* from the point of view of *Acoustic Communication*, the relationship between the listener and his environment mediated through sound. He points out how an interactive connection is formed exchanging information and how the relationship is maintained and how it breaks apart and what unintended consequences can emerge.

3.3. The Noise Chain

Acoustic distance is rather an exception in regard of a Schaferian noise polluted urban soundscape. The scenario of a *vicious circle* of noise is also used by Truax like Schafer. The intense level of noise is masking substantial information carried in sound signals and is endangering therefore the stability or balance of a specific soundscape or *acoustic community*.

Avoiding an exclusion of inhabitants from the community results in raising the volume / intensity level of foreground sounds to be heard by the inhabitants of the *acoustic community* which would result in a higher sound pressure level of the entire acoustic environment.

Truax describes it from a communicational point of view, that noise has less meaningful information and would lead to adaption and habituation which then again would follow an increment in a level of noise which would lead to the impossibility to establish communication. In other words, the dynamics or the resolution of an acoustic environment decreases with increasing sound pressure.

Truax extends the meaning and the consequences of the introduction of technology and the transformation of the acoustic environment into an electroacoustic environment. Although still behaving in the same patterns observed in the solely acoustic environment and subject to the same problematic of noise pollution, he points out that the electroacoustic environment, for instance of the radio medium is an extension.

The weaker sounds get masked by louder signals, a phenomenon similar to loudness war in music production.¹⁵ He also emphasizes the fact that technology is also mediating the forms of listening and also generating different forms of communities, based on the same principles established by an *acoustic community*.

The use of the term noise has, one should state in this context, a negative connotation, and I would assume that this was also the case before the *WSP* project was brought to life. The futurist, Luigi Russolo, discovered the musical possibilities of noise and already predicted a revolution in music in his manifesto *The Art of Noises* written in 1913.¹⁶

Noise is a central part of the debate on what is meaningful or aesthetically beautiful sound in general and which makes the idea behind the *WSP* so powerful.

3.4. Explaining the Core Idea of the *WSP*

The core idea of the *WSP* is based on a holistic concept of a soundscape being an interactive musical composition which is in a harmonic relation with its inhabitants.

The natural acoustic environment, I assume an environment before the industrial revolution, is taken as a central reference for an acoustic environment being in equilibrium.¹⁷

Schafer is extending the fundamental idea of music by integrating and interpreting sounds from our environment as part of a global orchestra. A fundamental notion is that the inhabitants of this acoustic environment are also its composers, performers and its audience at the same time.¹⁸

15 A phenomenon also discovered by Bob Katz in the development of the skill of mastering, the last step of the production chain in music production. B. Katz coined the term Loudness War in regard of the increasing sound energy level on media. (Katz 2007, p.167)

16 (Lista 2009)

17 (R. Schafer 1994, p.207)

18 (R. Schafer 1994, p.205)

To save the world from the increasing problem of noise pollution Schafer mentions the solutions of creating a universal auditive awareness of the acoustic environment and its inhabitants through educating *acoustic designers*.¹⁹

The constitution is based on a subjective selective listening process with the intention of searching for compositional qualities and means.

3.5. Listening in Practice

Schafer mentions noise pollution as a consequence of the fact that music education did not succeed in making the society aware of its immersed soundscape and its current state of quality. Listening in Schafer`s view is thus strongly connected with education and practice a priori, to learn how to listen. An extensive collection of publications by Schafer in the context of music education has been released.²⁰

He suggests ear cleaning exercises, *listening walks* and *soundwalks* to reach the capability of *clairaudience*, an extraordinary skill, and a prerequisite for any becoming *acoustic designer* being aware of the sounds of nature and the impact of human. The ability to listen to the soundscape as music, a piece of art.

3.6. Listening to Soundscape Recordings

Listening in the Context of the WSP also takes place through the act of recording and thus preserving sounds which is also a way of raising awareness for changes in the environment.

One distinguishes the utilization of field recordings used in music compositions in *electroacoustic* and *soundscape composition* as suggested by Truax.²¹

19 (R. Schafer 1994, p.181)

20 (R. Schafer 1994, p.181)

21 For example: *A sound education: 100 exercises in listening and sound-making*, *The thinking ear: complete writings on music education*, *creative music education: a handbook for the modern music teacher*

Electroacoustic composition uses environmental sound as its source. The sound loses its context through extensive treatment and the identity of the source of the sound may not be identifiable anymore.

The priority in the work of *soundscape composition* is to transport the environmental context of the recording which might be highlighting the social, political or artistic content. The material is unchanged in its form and the language is purely narrated by the techniques of montage, thus one could state a relation to the art of photography.

Westerkamp explores the multidirectional relationship between composers and their *sound-scape compositions* and the listeners. She understands *soundscape composition* as a tool for serving the goals of *Acoustic Ecology* by creating meaning and attention, however the success of a *soundscape composition* is unpredictable and lying solely in the hands of the composer and listener.²²

By listening to a field recording one experiences how our imagination gets transported to another location. The place of listening and the environment heard are out of context, in distinct realms or even *schizophonic*, a term coined by Schafer which defines the contradiction in context of the electronic reproduction of a sound and its diffusion to the acoustic environment.²³

The audio recording is changing the perception of a specific acoustic environment and one's relation to it. The musicality in a recording, the mediation of the recording artist can be understood as an improvisation, an expression using movement and proximity to a sound source, as noted by artist and researcher Andra McCartney.²⁴

By documenting an intense listening experience and communicating this through a *soundscape composition*, one is also importing and creating a context and meaning to the location where listening takes place.

22 (Westerkamp 2002)

23 (R. Schafer 1994, p.273)

24 (McCartney 2000, p.31)

3.7. Listening to Effects

I consider the *Guide to Sonic Effects* as an excellent tool for referencing and explaining effects of the acoustic environment of everyday situations. The guide establishes a vocabulary through examples and references with an extensive amount of information. It functions as an educative tool and does not only enhance the personal listening experience, but also could be used for analyzing a certain location according to the three different kinds of classifications, which serves the underlying theoretical framework.

The considerable amount of effects are divided in sixteen major and at the moment sixty-eight minor effects, an indefinite amount according to criteria based on their occurrence in the sound environment. In a further classification the effects are assigned to referring scientific domains.²⁵ These are then divided into six further Categories which helps in identifying effects with a common scheme.²⁶

3.8. The Paradigm of the Guide to Sonic Effects

The position of a listener in the paradigm of the *Guide to Sonic Effects* plays a significant, central role as the focus is on the listener and the perception of the effect. The implied structure of the guide does not support the examination of sound as an event by precise definition based on isolation and exclusion like in a closed concept like the *WSP*.

The guide also does not represent a definite encyclopedia of all the sonic effects but a repertoire.

In contrary, and I personally regard this also as the main strength of the concept, the intention is not to emphasize the object sound itself, but to put emphasis on the connections made to other fields of sciences, which interconnect with the realm of sound. In fact the underlying

25 Scientific domains: physical and applied acoustics, architecture and urbanism, psychology and physiology of perception, sociology and everyday culture, musical and electroacoustic aesthetics, textual and media expressions

26 Categorization of effects with a common scheme: Elementary Effects, Compositional Effects, Effects Linked to Perceptive Organization, Psychomotor Effects, Semantic Effects and Electroacoustic Effects.

concept is basically opening up by the nature of its definition. The fundamental idea is based on the relation between the occurred event and its consequences, the effect, as defined by the philosopher Gille Deleuze in *The Logic of Sense*.²⁷

Because the idea does not have an objective or only a subjective approach to the concept of the effect, but through the classifications accessible by the different domains, it reveals more on how an event is built up from different view angles. The guide also has a certain quality to be used independently of a particular culture because of the connection to objective points of views of acoustic science and because of the main assumption of this guide that the people approach the acoustic environment without a method or education or even prejudices in listening.²⁸

If one compares it to the underlying framework of the *WSP* which creates an aural awareness in a strong educative manner, one could also miss the quality of a manifesto and a more or less elaborate methodology on how to approach the phenomena of sound and listening in general in everyday life.

In the contrary one can also state this as an exceptional quality not to limit the interpretation and aim of perceiving sound solely to solve the problem of noise pollution.

One could criticize the *WSP* for being based on a paradigm of musical aesthetics which did not get explained in detail and which I suppose is mostly referring to western classical music ideals.

But as the research also takes place in the environment of western music culture I even would look at it as a strength. By referring to a musical concept and by approaching the soundscape from a totally subjective angle also implies that the paradigm of the *WSP* can be used as a culturally independent and locally adaptable model.

In this context I do not intend to support a dichotomous approach to sound in general or judge the likes and dislikes of sound of any kind. Instead I would like to highlight the fact that particular sounds, background noise symbolizes the peculiar kind of sound which connects social life, music, the physical properties of sound and space and the psychology of listening.

27 (Deleuze 2005)

28 (Augoyard 2005, p.13)

Background noise is maybe of subtle and unimportant nature on first sight but at the same time the soundtrack of our lives.

3.9. Background Noise

The term background noise can also be defined apart from a level of attention, thus is also related to the properties of a sound, its intensity level and texture. The term stands for a minimal average amount measured in Decibel (dB) of an acoustic environment and is the reference for establishing noise regulations on an objective basis. Therefore one can distinguish background noise apart from other sounds which are unstable in intensity and not continuous.²⁹

Schafer refines crucial keynote sounds of stable intensity as the the flat line in sound³⁰, which he mostly assigns to the inhumanly precise beats made by mechanical technology resulting from a lack of efficiency. Truax explains further the transformation of individual sound events merging to a continuum of sound, as a shift from pulses and vibrations towards distinct pitch.³¹

3.10. Creating Awareness

Being able to identify sonic effects is part of creating a general auditory sensitivity which is a goal shared with the *WSP*. Schafer and the *WSP* did not fail in creating attention for the acoustic environment. In the contrary one could also state that the controversial structure, like connecting sound with its context but also worshipping a musical ideal, did not fail its intention to make notice.³²

²⁹ (Augoyard 2005, p.172)

³⁰ By the flat line in sound, Schafer actually refers to a visualization of sound in amplitude and time made with an oscilloscope, a two dimensional representation of time on the horizontal axis and amplitude in the vertical axis. (R. Schafer 1994, p.78)

³¹ (Truax 1984, p.14)

³² (Kelman 2010)

Also by claiming that noise has negative influences and unmusical properties one does not recognize and accept it as part of the common acoustic environment.

*Electroacoustic compositions*³³ demonstrate that the “inner journey”, the experience of sound and the noises of our environment, and the explicit noise generated on purpose through modification of audio material are of similar nature.

The transformation of environmental sounds with media-specific or electronic means creates new meaning, new connections through abstraction of the recorded material. One could describe it as a transformation of the common sonic environment to the unknown and strange. Brandon LaBelle, a writer and sound artist, concludes that by producing the unknown, like in *electroacoustic compositions*, one generates the awareness, the sensitivity towards the acoustic environment.³⁴

This is at the same time the common source for communication, “the confrontation with difference” and also underlies communicational listening strategies explained by Truax as *listening for difference*.³⁵

The discourse about noise pollution is the driving force for creating awareness for an acoustic environment. The contradiction of characterizing noise as unwanted sound even as it actually attracts our attention is the source for creating attention, through which we are actually able to recognize our selves and our sense of sensing. One could exaggerate and suggest that noise in this context is even existential.

Noise is also used as a term meaning the self-noise of a closed system, also mentioned as the *black box model* by Truax.³⁶ The self-noise can also be expressed in a signal to noise ratio and is also related to the expression fidelity, in this case the fidelity of an input compared to its output.

The sound often referred to as a hiss or clicks or scratches or glitches in recorded audio are subject to its carrier. These kind of noises are failures and byproducts of the medium used and are revealing the technological process involved. Also the human body is making noise.

33 For example Hildegard Westerkamp's record *Transformations* (1996)

34 (LaBelle 2006, p.214)

35 (Truax 1984, p.17)

36 (Truax 1984, p.30)

One could explain noise as a part of any process including life, as the noise of being, or maybe also in the sense of *Acoustic Communication* as the self-noise of communication.

3.11. Creating Aural Communities and Territories

Acoustic communities are built with sound. Also noise is a proof of the existence of a community.

The creation of sound unites and generates social bonds in terms of exposition to the same *sound signals* or also the involvement in actively making noise. Communicating and sharing the same focus of attention by listening creates bonds and communities.

The act of remaining silent or listening to a silent performance got explored by John Cage in his famous piece 4'33. To remain silent intentionally in groups of people demonstrates a strong social connection, as it is also used in many cultures for paying respect or solidarity to a deceased individual.³⁷

The interesting connection between a community and a physical space as a defined enclosed area is the common area of attention but also the *acoustic space* determined by the spatial condition for example a closed room or a landscape with mountains.

Interestingly, we can create or establish or define a space with sound. And we can create a community with sound. So we also define space which is not only bound to physical visual space but rather defined by its content or effect. In this case one speaks of a space created by music or sound not a room containing music like the idea of “auditory space” imagined by McLuhan and Carpenter, a model that explains the dimensions created by a medium itself.³⁸

The composer Eric Satie was inspired by the nature of the connection between space and music which he explored with a series of works which he called *musique d'ameublement*, furniture music, which are rather short pieces of music that are repeated for a certain amount of time. The idea is based on the fact that music merges into the background and also that the music does not provide a narrative scheme to its listener but supports a given situation.

³⁷ (Blessner 2007, p.33)

³⁸ (Carpenter & McLuhan 1968, pp.65–70)

Also other musicians and composers got inspired by producing music for an exact place or by solely working with the imagination of a specific place and mood, creating ambient music.³⁹

Often background ambiances are diffused, especially music, to mask disturbing noise but also to create atmospheres which make a deserted or narrowing space feel more comfortable or even inviting. In this way the power of Sound is manipulating our perception of a physical present space and is creating a dimension that goes beyond the understanding of space defined as physical boundaries. Background sound in form of music is mostly used at events of people gathering.

By masking the sound people make, or by using sound to induce life in an empty space one is unnoticeably trading the feeling of loneliness or emptiness against independency or individuality.

Westerkamp has been exploring the phenomena of background sound in form of music in a commercial and political context and sees the consequences in loosing the perception of the individual, oneself and the other.⁴⁰

For Truax the conflict lies in the power to control emotions which are not based on human interaction with an environment but which can be manipulated by inducing music into a space.⁴¹

A location in our environment, a space, can also be regarded as a mnemonic point in our cognitive map addressing all our senses of a specific location. The spatial acoustic properties of a space, its resonance, its mental interpretation, the context of being there, its experience form an auditory spacial awareness, a term coined by Barry Blesser and Linda-Ruth Salter, which incorporates the “internal experience of an external environment”.⁴²

A term emphasizing the existence of a mental model, a cognitive representation of our environment which combines the process of physiologically sensing an environment but also includes emotional interpretations.

39 For example Brian Eno with a series of works: *Discreet Music* (1975), *Music for Airports* (1978), *The Plateaux of Mirror* (1980), *On Land* (1982)

40 (Westerkamp 1988, pp.146–150)

41 (Truax 1984, p.121)

42 (Blesser 2007, p.131)

The spatial acoustic properties of a room are essential in this context. The existence of a room tone, or *Eigentone*⁴³ as Schafer notes, resulting of the fundamental resonance of an enclosure is also part of the process of forming a mental model of a given space.

The spectral characteristics of a room investigated by several sound artists reveals not only the spectral fingerprint of the place of recording and diffusion, but also the connection of a place and time, incorporated in an audio recording into a context which goes beyond the domain of acoustics.⁴⁴ The sound of a room is an expressive tool used in sound design of films to establish and transport the mood and the aural perspective of an actor, or the subjective perception of a location, a technique used extensively in David Lynch's films.⁴⁵

3.12. A Consumption Cycle supported by Sound

The quality of sound to mark acoustic territory in public space is utilized strongly by shops to create attention and attract consumers, thus this aspects of sounds is strongly related to sound or music branding in the context of the shops corporate image.

Associating a brand or a service of a company with a chosen music genre to reach a certain kind of audience or clientele is part of the representation much like the decoration in the display window.

This works by selling the means for representing lifestyle and forming identity and cultures based on recognition and acceptance through repetition, a phenomenon that philosopher and musicologist Theodor W. Adorno has examined in his essay on popular Music.⁴⁶

By widening the concept of storing sounds and their context, sound archivist Tony Schwartz points out how our perception of sound gets influenced by the creation of an ideal by the media and how the media is using our way of perception to connect and evoke these stored contexts in a common language or even common space.⁴⁷

43 (R. Schafer 1994, p.213)

44 Works by artists which reveal the spectral character of a specific location: Alvin Lucier *sitting in a room* (1969), Die Tödliche Doris, *Liveplaybacks* (1986), Jacob Kirkegaard *4 rooms* (2006)

45 For example: Eraserhead (1977), Blue Velvet (1986)

46 (Adorno et al. 2002, p.437)

47 (Schwartz & Schwartz 1974)

Inside a shopping mall one nearly always finds oneself in the middle of a diffuse staging of loudspeakers emitting a seasonal suiting playlist or a genre of music tailored for particular type of goods.

The possible powerful arising feeling of disorientation which the *Guide to Sonic Effects* relates to the *ubiquity*⁴⁸ effect is a consequence of the omnipresent diffusion. It is based on the spatial conditions which make it impossible to locate the origin of a single sound and can also be found for example in acoustic conditions with lots of reverberation and is strongly connected to a demonstration of power. To not know where a sound comes from, is also believed to be a manifestation of god or supernatural forces.

This is not a recent phenomenon, as the american company Muzak Holdings, operating since the 1930s, was famous for delivering seamless instrumental arrangements without silent gaps in between.⁴⁹

The diffusion of sound in public space has found total acceptance in society through the years. The phenomenon also created specific music genres of its own with the purpose of creating a constant mood or rhythm, an ambiance where business is fruitful.

One could also speak of a creation of a flow as a mechanism for advertising, also spotted by musicologist Robert Fink as not solely an invention of minimalist composers.⁵⁰

I would like to emphasize the fact, that by giving up individuality or personal freedom in connection with background sound and public space as mentioned by Westerkamp, one is also creating the need or urge for identity which is, not suprisingly, a profound and fundamental reason for consumption.

48 (Augoyard 2005, p.130)

49 *Elevator music* also inspired J. Cage for a conceptual piece for the open public commercial space with the name *silent prayer*.

50 (Fink 2005, p.128)

3.13. Music of the Last Century

Parallels between our acoustic environment driven by sounds made by technologies and compositional approaches merging are undeniable. My attention was attracted by two prominent composers whose works are musically distinct, even opposed and of which one could say that their inspirational roots lie strongly in the acoustic environment of the last century. The work of La Monte Young relates to the *drone* sound effect, and the work of Iannis Xenakis connects to the sound effect of *metamorphosis*.

Both composers work with architecture in context of sound in their specific own way and make use of a mathematical approach to composing.

They broke up with serialism and went on to explore a universe beyond its established musical aesthetics.

Their works emphasize pitch and the relation to time, the vertical axis of a score and share an ideal utopia, an understanding and awareness for harmony beyond its definition in music theory.

3.14. La Monte Young

The *Guide to Sonic Effects* categorizes a *drone* as a compositional sound effect, a sound continuum, characterized by an amount of sounds which are seemingly similar in pitch and intensity also formed by the spatial acoustic diffusion. The drone resembles a musical tonic in a piece of music or an acoustic environment, similar to Schafer's description of a *keynote sound*.

The character of the sound being stable in intensity and pitch makes the sound identifiable.

By analyzing the frequency spectrum in time one can identify and measure its spectral energy from a given acoustic environment, thus objective comparisons can be made between different locations.⁵¹

51 (Augoyard 2005, p.40)

The *drone* is part of any modern urban acoustic environment. I am referring to the effect as if it would be a physical object. A drone proves strong territorial qualities like a smell or a perfume.

The homogeneous character of the sound and the lack of high frequencies due to the properties of sounds emanating from far away do have a strong permeating quality.

Electricity is the source for precise beats and continuous indefinite sounds.

The meaning of a continuous sound implies that the sound emerged with an intended on set or attack in the past. We have the experience and knowledge that every sound has a reason and is an effect, a cause of a process. A sound without causality will either take us back to an embryonal state of perception or then one will invent a causality, which musician and author David Toop suggests as the mediumship of the listener.⁵²

One is quite certain about the fact that the sound will decay in future, but still one finds himself in a state of readiness, a tension created by the continuity and the process of *listening for difference*.

At the same time we discover a lot by listening with a small amount of information. A listening experience which one could compare with Pauline Olivero's "listening to listening" at least on the basis of a similar notion.⁵³

Young's installation works and his compositions include a concept of sustained tones and chords, long durations in a specific scale at tremendous loud volumes which tend to operate on the borders of human perception.

It is not a coincident that installations⁵⁴ of Young exhibited in North America are based on a 60 Hertz tone and works showed by him in Europe are based on a 50 Hertz tone.⁵⁵

Drones created by electric devices used in everyday life are all in relation to the standards used in the AC networks.

52 (Toop 2010, chap.IX prelude)

53 (LaBelle 2006, p.158)

54 For example *The Dreamhouse Installations* or *The Romantic Symmetry (over a 60 cycle base) in Prime Time from 144 to 112 with 119*.

55 (Grimshaw 2011, p.45)

The fact that the audience at his concerts or installations is free to move in the space and that the spatial acoustic phenomenon of standing waves and phase shifts change the listening experience by even slight motion proves that the properties of the room and the movement by the listener is essential for Young's work. His collaboration with Marian Zazeela's illumination works creates one unit, an entity of space, sound and light.⁵⁶

3.15. Iannis Xenakis

From the acoustical aspects of Xenakis work one could also explain with the sound effect strongly related to the mnemo-perceptive organizational category called *metamorphosis*.⁵⁷ The term is directly derived from his work *Metastasis*.

The effect stands for the instability of a sound structure in a composition in time and the impossibility to distinguish individual sounds. Some sounds have a long duration and some are short, some are loud and get silent and some merge. Each individual sound is indistinguishable of the whole. The composition forms one unity. Our attention is unstable and in a constant movement between background and foreground sounds.

Xenakis creations of sound fields and aggregates of sound are leading back to his own experiences and exposures to incidents during the Second World War.

In reaction to serialism, which he claimed focuses too much on the linearity in composition, he developed the concept of stasis, conditions and stable states which led him to create clusters and crowds of sounds by producing a large number of events on the vertical axis of the score. His works expanded into polyphonies and glissandos relating time and pitch directly to each other.

One could also see a connection in the preciseness of sound events in his compositions, a quality usually associated with machines. Xenakis's practice of architecture and his past work on Modulor⁵⁸ led him to create spatial sound and light concepts incorporated in the audio-vis-

⁵⁶ (Fleming & Duckworth 1997)

⁵⁷ (Augoyard 2005, p.73)

⁵⁸ A scale referring to human proportions which was used as a strategy for harmony in architecture by Le Corbusier.

ual compositions of his polytope series but also to translate musical concepts like the glissando into the architectural domain.⁵⁹

3.16. Exploring Sonic Territories by Movement

Actively listening to the acoustic environment involves movement. A setting where the sound source are stable in place while the listener is free to move around emphasizes the awareness of its listener and the explorations of sound sources and their defined territories.

Acoustic defined space by electronic sound is also adapted by Max Neuhaus with the work

Three to one (1992) in Kassel as a permanent installation. The piece relies on the diffusion of sinus frequencies determining a sonorous space and expanding over three rooms which are connected through a staircase.

The work of Tristan Perich's *Interval Studies*⁶⁰ which divides a given interval into an amount of equal steps amplified by loudspeakers arranged in a grid in the dimension of a picture frame, also invite for an exploration in the context of a gallery space. It examines the discourse of merging regions and discrete sounds, but also formally illustrates an interval of discrete pitch and its steps as a continuum. Both installation share the characteristic of exploring discrete sounds.

In the context of creating areas I should also point out the existence of electronic mediated territory, which can also be explored by movement. For example radio space which got investigated through the work *Drive In Music* in 1967 by Max Neuhaus. The listener is driving by car through regions established by radio transmitters emitting particular pitches of electronic sounds. Although the perception of the piece is mediated through the radio receiver, it exactly demonstrates aural territories on a mediated level with the difference to an acoustic piece that the mediated areas cannot be perceived as a whole. The aural explorer is driving with his car in a private *acoustic space* through public space but also through public radio space.

⁵⁹ (Xenakis & Kanach 2008)

⁶⁰ (Perich)

I consider the listener's active role of exploring the composition through her own movement in these works as central and as a main characteristic.

Likewise, augmented sonic reality games mediated through the use of smart phone applications like *Inception* or *Dimension*⁶¹ are built on a similar idea but on a technically further developed platform meant to hijack a listener to another dimension of narrative sonic game structure, where the meaning of Schafer's term *schizophonia* is taken into perfect account.

Time and space are connected through movement. LaBelle speaks of a shift from the use of time in music, the horizontal axis of a score, to the exploration of space of a sound.⁶²

A listener is also perceiving space through time, but he is also determining the durations of events by his movement.

The awareness of a sum of sound events which can only get perceived through one's own movement is the core idea of my practical work which I will detail in the following chapter.

61 Created by the RjDj team and released in 2008, <http://inceptiontheapp.com> ; <http://dimensions.rjdj.me/> (2011)

62 (LaBelle 2006, p.162)

4. The Spatial Aural Exciter

4.1. The Idea

My practical work, as part of this thesis, is creating a network of sound generators to experiment with the relationship of densities of electronic sound events and their temporal and spatial diffusion.

The aim is to develop a prototype which can be used as a tool for further artistic explorations with the qualities to act as a spatial intervention and a sonic network at the same time.

I am intending to diffuse electronic sounds in the same location where the sounds get created.

The Spatial Aural Exciter node is an electronic sound generator and part of a diffusion system in one unit with the possibility to be controlled digitally. Its a network which is using the acoustic properties of its environment and the distance between neighboring nodes to create the impression of space.

The discrete node is creating its own *acoustic space*, its area to be perceived, and is merging or overlapping with other areas of other nodes of the network while blending with the given acoustic situation.

I am not intending to generate a sound system of high fidelity in terms of the sound quality concerned with the reproduction of recorded sound. By electronic sound I mean the possibility to create as pure synthesized electronic signals as possible within the limitation of the technology used.

The aesthetic decision to use electronic sound for a public sound intervention did not happen just by chance. Electronic *sound signals* are used to attract attention because of their pureness in tone and the quality of being easily distinguishable out of a mass of sounds. They are sounds which are not part of the natural soundscape imagined by Schafer, but they are truly part of the urban soundscape.

I would identify the interaction of a listener to be similar to the experience of watching an object through a microscope and getting aware of its size and fullness of variations by moving the glass under the lens to discover different areas on the slide.

4.2. A System of Diffusion

The concept of diffusion is easily distinguishable from any commercially available sound format or sound diffusion system which make it possible to listen to reproduction of sound in a closed environment, like a concert hall or a movie theatre or a home or a car stereo.

Technologies of sound diffusion which are focused on the reproduction of sound in the most authentic way to create the illusion of a space and the acoustic situation are all limited to specific acoustic spatial conditions and by a sweet spot, the focal area, where the illusion takes place.⁶³

I am not intending to create a sound system which has the capacity to model or represent spatial properties or even generate virtual acoustic environments in a given space.

One could compare the Exciter network with the listening situation used in certain electroacoustic concert situations, a so called *acousmonium*.⁶⁴

It is a staging of an electroacoustic piece with the quality of spatialized polyphony in the sense that the space and the way sound is spread merge to one unity, a undistinguishable instrument for the purpose of sound projection.

It is important to state that the actors, the nodes of the network are all of the same kind. The structure is based on a fixed distance between its actors. The nodes of the network are able to create different pitches but the capability in generating various tones is limited by the realm of digital synthesis and the piezo transducers. Therefore I should be speaking of a cloud of sound

63 Sound diffusion setups like Stereo, Quadraphony, Surround, Direct Audio Coding (DirAC), Wave Field Synthesis (WFS)

64 For example: the *Acousmonium* by Francoise Bayle (1974), the *Audium Theatre* in San Francisco (1965-) but also Karlheinz Stockhausen's *Spherical Concert Hall* at the Wold Expo in Osaka (1970).

or a cluster sound, because the properties of the sound events created by the nodes are very similar and not individually separable by a distinct sonic character.⁶⁵

The nodes fuse to an undistinguishable sound and is not comparable to the spectral diversity of an orchestra or *acousmonium*.

From the spatial acoustic point of view the Exciter network is using space as a resonance body, similar to an organ, an instrument assimilated into its room as a spatio-musical expression.

In this sense I would like to mention three works by different artists using a mass of instruments⁶⁶ emphasizing the spatial quality of sound, the single sound event and the interval of a moment.

4.3. The Spatial Moment

The works act in a similar context but still provide variation in interpretation and transported content:

The *Poem Symphonique* is a composition consisting of 100 mechanical metronomes and ten performers composed by György Ligeti in 1962. The metronomes get started on a stage at the same time at different speeds. The sound of the mass of ticks begins to get periodic after the metronomes run out of the implied energy and individual metronomes get locatable.

Another installation encountered in the context of art exhibition is *1000 Clocks*, a work by Richard Jackson exhibited at the Venice Biennale in 1999. One enters a white painted room made out of symmetrically aligned clocks on all the walls and ceiling. The space is lit by cold neon lights. It is silent. When trying to escape the narrowing feeling of immersion in the powerful display of time through the exit which is situated on the other side of the room, the pointers of the clock move to the next minute which results in a tremendous loud and fairly synchronic deep and heavy clack sound. What a moment.

⁶⁵ Comparable to an ensemble of strings. For instance in the piece *Atmosphères* by György Ligeti.

⁶⁶ One could relate the effect also to the aural illusion named *Zeno paradox*. The sum of individual sounds result in differences.

I experienced the work *Coincidence Engine Two* created by the artist duo *The User* exhibited in 2009 at Santralistanbul in Turkey. An installation similar to a small scale arena, a staging consisting of an immense amount of ticking clocks at same intervals but different times perceivable as a subtle homogeneous dense noise floor.

4.4. Personal History and Experiments

4.4.1. Binaural Ambisonic Simulations

In the beginning of my studies at Media Lab I was very interested in the possibilities of creating virtual sonic space. I created a patch with the graphical programming environment Pure Data⁶⁷ (Pd) which enables a user to position sound in a virtual space with externals by Thomas Musil and Georg Holzmann.⁶⁸ (see figure 1)

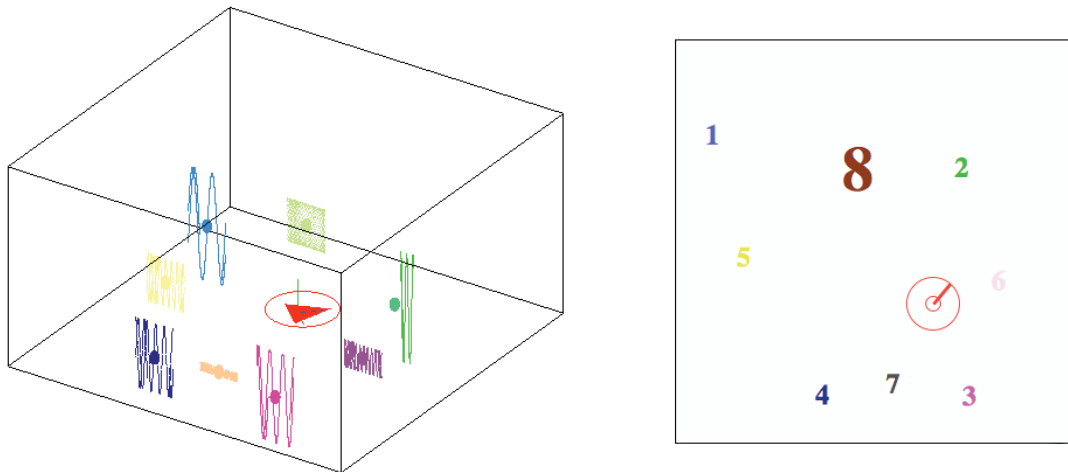


figure 1 Pure Data Screenshots of the visualization and the interface to control the position of the soundsources.

⁶⁷ Pure data - PD Community Site. Available at: <http://puredata.info/> [Accessed March 3, 2012].

⁶⁸ (Musil)

The illusion of space is only perceivable by using headphones and thus limited the usability in general. I was not really satisfied by the results and started to develop the idea to diffuse sound in the same place where it gets generated without any sonic illusion, similar to the idea of diffusing and creating movements of sound in Bernhard Leitner's *Sound cube* (1969) or Peter Vogel's kinetic soundsculptures like *Klangkugel* (1975).

4.4.2. An Analog Oscillator

The idea started to take form by building a simple analog oscillator circuit and connecting it to a piezo speaker. I was searching for the most cost effective way to produce electronic sound.⁶⁹

The oscillator emitting a pulse wave with variable pitch was then placed somewhere in my room, creating a subtle drone, loud enough to mark its own territory or acoustic space. An analog controlled Spatial Aural Exciter was created. (see figure 2)

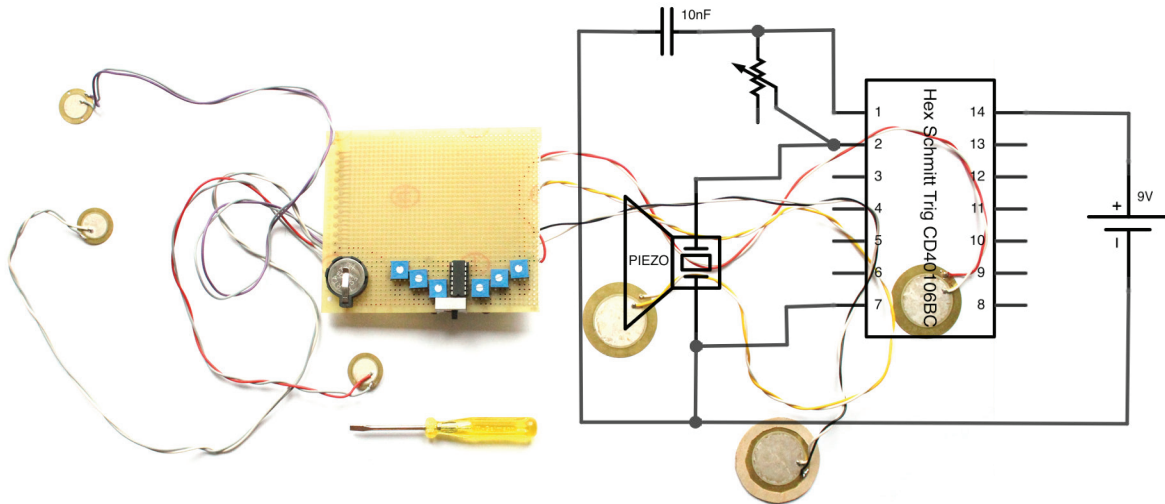


figure 2 A photo showing a six oscillator setup powered by a 3 Volt battery and the schematics showing the connections of one oscillator.

⁶⁹ (Collins 2006, p.111)

4.5. A Network of Exciter Nodes

After several simulations with a computer, a sound card with 6 attached speakers and a Pd patch capable of routing different sounds to 6 audio outputs, I decided to separate the sound synthesis from the controlling computer and made a prototype with an arduino as a sound generator.

I chose the arduino platform⁷⁰ because of its inexpensiveness, reusability and wide interfacing possibilities, even though the quality of sound is limited by the specifications of the chip.

Other possibilities would have been to use a high quality DDS Chip AD9833 which also would have needed an interface like an arduino to communicate with. This would have resulted in higher costs.

The arduino was the solution for creating synthesized sound using the Tone library and for controlling the network digitally with a single unit or with a computer in an affordable price.

4.5.1. Designing the Printed Circuit Board of an Exciter Node

The form of the printed circuit board (pcb) is based on the concept of how I will create a net of nodes. Therefore, I have to create the possibility that the nodes can be connected to each other physically by a string to define a stable net. I chose to do this with a minimum of 3 points and by placing the chip generating the desired sound on one side of the pcb and the piezo diffusing the sound on the other side of the single layered pcb.

On the right side (*figure 3*) I show a screenshot of the pcb drawn with *Fritzing*⁷¹. The routing of the copper lines is defined by the data connections to the ports of the Atmega 328P chip. The schematic is based on a reduced version drawn by Tim Anderson.⁷²

70 Arduino - Homepage. Available at: <http://www.arduino.cc/> [Accessed March 3, 2012].

71 Fritzing. Pcb design. Available at: <http://www.fritzing.org/> [Accessed March 3, 2012].

72 (Anderson)

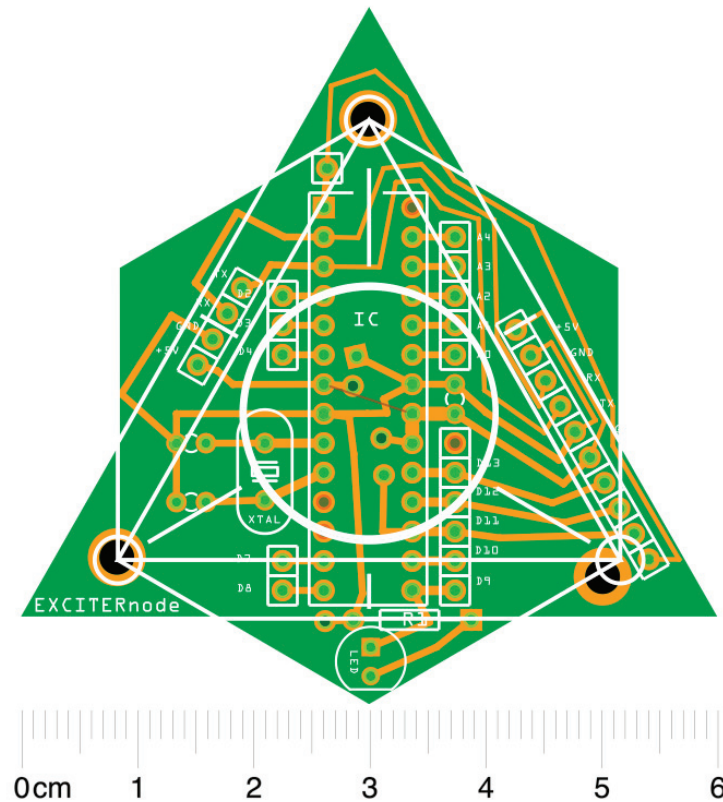


figure 3 Pcb form and layout.



figure 4 The photo shows a prototype of a network made out of cardboard.

4.6. Conclusion

At the point of writing these concluding words my work is still in progress.

It defines a node as part of a net of sounds. I will exhibit this work as part of the Masters of Arts (Moa) exhibition. However, I also see the structure defined therein as a platform also involving interested people to compose interventions with the established framework.

My practical work is about sensing sound as space but also perceiving a mass of spatial sound events as a whole. The core idea lies in the the exploration of sound by the active movement of the listener. It creates an awareness to density and emphasizes the possibility of exploring sonic details.

The idea is not to entertain or sell an illusion. The intention lies more in the realization of how valuable acoustic space in general can be, a place where social conventions take place on the basis of visual and auditory communication.

The sensory stimulation created by the reality surrounding us is still the most puzzling and self reflecting environment one is able to investigate without using any media.

This is why I actually just would like to slightly excite the auditory sense to emphasize the mass and detail of sounds surrounding us which are just waiting to be explored.

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